REMARKS

This is in response to the Office Action mailed on September 15, 2008, in which the abstract was objected to, claim 4 was objected to, claims 1 and 2 were rejected under 35 U.S.C. 102(f) as being anticipated by Applicant's Admitted Prior Art (AAPA), claims 1-3 were rejected under 35 U.S.C. 102(b) as being anticipated by Zintel et al. (U.S. Pub. No. 2002/0035621), and claim 4 was rejected under 35 U.S.C. 102(b) as being anticipated by Zintel et al. or alternatively under 35 U.S.C. 103(a) as being unpatentable over Zintel et al. in view of Waldo et al. (U.S. Pub. No. 2001/0002473).

Objection to Abstract

The abstract was objected to for exceeding 150 words. With this Amendment, a substitute specification is submitted that includes an amended abstract that includes less than 150 words. This objection should accordingly be withdrawn.

Objection to Claims

Claim 4 was objected to for an informality related to antecedent basis. With this Amendment, claim 4 is amended to correct this informality, and the objection to claim 4 should accordingly be withdrawn.

Rejection of Claims over AAPA

Claims 1 and 2 were rejected under 35 U.S.C. 102(f) as being anticipated by Applicant's Admitted Prior Art (AAPA).

The technical problem solved by the present invention is to network home devices and share resources in cases where there is a resource management device and also where there is not a resource management device. In cases where there is no resource management device, a device that initiates a connection broadcasts its own device information in a multicasting manner before networking is established so that devices in the network can be aware of each other and then

establish a connection. In cases where there is a resource management device, a relevant device is searched through the resource management device directly.

In contrast, the Background of the Invention describes that, in cases where there is no resource management device, the device conducts a searching operation in the network to establish a peer-to-peer connection, and in cases where there is a resource management device, a searching operation is conducted also in network. Because searching in the network is a time consuming operation, this is a disadvantage in the prior art. However, in accordance with the invention as claimed in claim 1, in cases where there is no resource management device, the device initiating a connection multicasts its own device information to allow devices that want to establish connections to quickly find out about each other and then establish connections, and in cases where there is a resource management device, the device information for each device can be retrieved from the resource management device. Accordingly, the claimed invention is new over the prior art recited in the Background of the Invention, and the rejection of claims 1 and 2 under 35 U.S.C. 102(f) should accordingly be withdrawn.

Rejection of Claims over Zintel et al.

Claims 1-4 were rejected under 35 U.S.C. 102(b) as being anticipated by Zintel et al. (U.S. Pub. No. 2002/0035621).

The Zintel et al. publication, in paragraph [0012], teaches that a device that wants to join in a network sends a request to other devices. However, as taught in the Zintel et al. publication, the device that wants to join in the network sends a discovery request specifying a desired type of device or device capability, and the other devices in the network monitor the request. If the devices can satisfy the condition contained in the request, the devices respond to the request and establish a connection with the initiating device.

In contrast, in the claimed invention, the initiating device actively announces it own device information to all devices in the network in a multicasting manner, and then the devices establish corresponding connections by using the received device information. By doing so, the

process of joining the network consumes a shorter period of time than can be achieved according to the Zintel et al. publication.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." M.P.E.P. 2131, citing Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). In this case, claim 1 as amended explicitly recites that in the case where there is no network resource management device, an initiating device announces its own device information to all other devices in the network in a multicasting manner. This limitation is not disclosed, taught or suggested in the Zintel et al. publication or elsewhere in the prior art of record. The rejection of claim 1 under 35 U.S.C. 102(b) should accordingly be withdrawn. Claims 2-4 depend from independent claim 1, and for at least that reason are allowable therewith.

Rejection of Claims over Zintel et al. and Waldo et al.

Claim 4 was rejected under 35 U.S.C. 103(a) as being unpatentable over Zintel et al. in view of Waldo et al. (U.S. Pub. No. 2001/0002473).

Claim 4 depends from independent claim 1, and for at least that reason is allowable therewith.

CONCLUSION

In view of the foregoing, all pending claims 1-4 are in condition for allowance. Notice to that effect is respectfully requested.

The Commissioner is hereby authorized to charge any additional fee required under 37 C.F.R. 1.16 and 1.17 and credit any overpayments to Deposit Account No. 11-0982.

Respectfully submitted,

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A METHOD OF SEARCHING FOR DEVICES AUTOMATICALLY IN A NETWORK

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates to device searching technologies in a network, more specially, to a method of automatically searching for each other among devices in a digital home network.

DESCRIPTION OF THE PRIOR ART

With improving of the material life of the people, devices in a home such as information devices, communication devices, entertainment devices, home electrical appliances, automatic devices, and security monitoring apparatuses are gradually increasing. Meanwhile, due to the rapid popularity of personal computer and Internet in home, flourish development of telecommunication technologies and great improvement of intelligent devices, home network gets more and more attention, and the desire about a simple, flexible and reliable home network is increasing. Thus, a lot of concepts about home network are proposed, such as Smart Home, Electronic Home, e-Home, Digital Family, Network Home, and Intelligent Home. Specifically, Home network has the following four hierarchical meanings: (1) the information devices, communication devices, entertainment devices, home electrical appliances, automatic devices, and security monitoring apparatuses in the home are interconnected and communicate with each other, share resources and form a home intelligent network system; (2) the system is connected to community and Internet by means of a gateway so as to effect the information exchange with the circumstance outside the home; (3) the devices in the home and the connected network should meet a basic requirement of security, convenience, comfort, health and green, so as to provide a pleasure experience to people; and (4) it is easy to use, safe and reliable, convenient to maintain, and inexpensive so as to fulfill the requirements of home life.

In view of the above, the applicant has proposed a digital home network system in another application, as shown in Fig. 1. This system is mainly composed of a gateway 11, more than one backbone network devices 12 and a plurality of control subnet devices 13. The gateway 11 further includes a home gateway 110 and a control gateway 111, and the home gateway 110 is connected with the control gateway 111 via a broadband interface. Based on the configuration of the system, this digital home network is composed of two subnet, backbone network and control subnet. In which, the portion of network formed by the home gateway 110 and those home devices connected with it is called as backbone network, and the backbone network is mainly used to realize interconnections among the information devices, the communication devices, the entertainment devices and the like. And the portion of network formed by the control gateway 111 and those home devices connected with it is called as control subnet, and the control subnet is mainly used to realize interconnections among the home electrical appliances, the automatic devices and the security monitoring apparatuses and the like. The key idea of such a digital home network is to make the home devices on the home network connect and communicate with each other and share resources. In this home network system, the home gateway, the control gateway and the server can be collectively called as resource management devices and used to manage network resources.

Based on the above network configuration, the interconnections and resources sharing among network devices are achieved as follows.

When a certain device A apply to access a home network, the device A firstly searches resource management devices in the home network, after finding out, it sends a registration request to the resource management device immediately. After the permission of the resource management device, a connection relation is established between the device A and the resource management device on basis of security authentication. After successfully connected, the device A performs a device registration to the resource management device in the network, that is, sends its own device information to the resource management device. Then, the

device A registers services it can provide into the resource management device, and the latter stores all of the device information and the service registration information for searching.

When two devices which have connected with the home network are going to communicate, the device A actively initiating the operation firstly sends a device searching request to the resource management device. The resource management device searches in the device information stored thereon if there are any appropriate devices. If so, the corresponding information is sent to the device A. And the device A sends a request to a device B. Upon permitted, the device A performs a service call to the device B. After the completion of the current operations, the two devices disconnect automatically.

When a device leaves a network, the device will perform a device cancellation operation, and those relevant information including device information and service information are deleted from the resource management device.

In the course of the above operation, a resource management device may exist or not. If there is not any resource management device, after respective searching procedures, a peer-to-peer connection is formed between the devices by self-negotiation so as to perform communications. When there is a resource management device, the resource management device will perform a device announcement periodically, that is, announce its own device information to other devices. Those devices other than resource management device can also perform the device announcement in other cases.

During the entire procedure of communications, what should be preliminary solved is the problem of discovering each other among the devices. A conventional device discovering method consists in that a user of device inputs device information manually, and then the devices can discover each other. For example, when a user purchases a printer, users who utilize this printer though network must know

information about the printer such as its IP address, and then after setting the information about the printer on its own computer, can use the printer properly. Such an operation manner is very inconvenient to user, and with the increasing of the information devices, these manual operations will be more and more unacceptable.

SUMMARY OF THE INVENTION

Therefore, a main object of the present invention is to provide a method of searching for devices automatically in a network which makes automatic searching for and connecting with each other among devices possible so as to facilitate the user's operation and improve automatic and intelligent performance of the network.

The object of the prevent invention is achieved by the following technical solutions:

A method of searching for devices automatically in a network, including at least following steps of:

a. firstly searching, by a device initiating party, whether a resource management device exists in the network when two devices are interconnected; if so, going to step c, otherwise going to step b;

b. announcing its own device information, by the device initiating party, to all other devices in the network, at the same time, monitoring announcement information of all the other devices; when receiving information of other devices, sending a connection request from the device initiating party to a device requiring connection, and completing corresponding operations after receiving a response; for example, the device initiating party sends a peer-to-peer connection establishing request to a partner device, after receiving a response, a peer-to-peer connection is established between these two devices;

c. sending a device searching request from the device initiating party to the resource management device; upon receiving the request, making a search, by the resource management device, among device registration information stored therein; after a device satisfying conditions is found out, information related to that device being immediately sent to the device initiating party, otherwise, informing the device initiating party that the information is not found. The resource management device may send the information related to the device to the device initiating party in a format of device announcement.

In above solution, the step b further includes the step of: after receiving the request of the device initiating party, judging, by a requested party device whether it is accepted or not; if it is accepted, sending a connection accepted response from the requested party device to the device initiating party and then performing device connecting between these two devices; otherwise, sending a connection rejected response from the requested party device to the device initiating party.

The method further includes the step of: when each device applies to access the network, firstly registering its own device information onto the resource management device and forming a master-slave devices relation with the resource management device. Before registration, the resource management device announces its own device information in a multicasting manner, and before the device applying to access makes registration, it firstly receives the device announcement information of the resource management device.

As it can be seen, according to the method for searching devices in the home network proposed in the present invention, when there is no resource management device, each devices issues its own device information over the network in a multicasting manner such that the devices can get known about each other in advance, and then establish connection relation with the devices desired to connect; and when there is a resource management device, each home device can make a search whether a desired device exists or not by means of the resource management device so as to establish a connection relation with that device. Thus,

an automatic search among network devices is achieved, and a more convenient service is provided to users, and the automatic and intelligent performance of the network is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic diagram of the structure of the home network according to the invention.

Figure 2 is a flow chart of the device discovering process of the invention.

Figure 3 is a schematic diagram of the peer-to-peer connection relations among devices when there is no resource management device.

Figure 4 is a schematic diagram of the relation between the master device and the slave device when there is a resource management device.

Figure 5 is a schematic diagram of messages in the device searching procedure when there is a resource management device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereunder, the present invention will be described in detail with reference to the attached drawings.

With respect to the whole digital home network, the connections among home devices may be through a resource management device, and may be not through the resource management device. Therefore, there are correspondingly two cases in the mutual discovering procedure of the home devices, that is, one case where there is a resource management device, and the other case where there is no resource management device.

As shown in Fig. 2, the device discovering procedure includes at least the following steps:

5   a. at steps S101-102, when a certain device A is going to interconnect with other devices, this device firstly searches in a digital home network, whether a resource management device exists or not, if so, the procedure goes to step c, otherwise goes to step b.

10   b. when there is no resource management device, at step S103 each device in the network periodically announces its own device information to the network in a multicasting manner, and simultaneously listens to device announcement messages of other devices to obtain information about other devices. At this time, all home devices communicate and share resources in a peer-to-peer manner, and

15   the peer-to-peer connection relations among devices PTP1, PTP2, PTPI and PTPN is shown in Fig. 3. So-called multicasting manner in fact refers to broadcasting, but the object of the broadcasting may be either the entire home network or a specific subnet pre-partitioned. Then, a corresponding point-to-point communication manner is referred as unicasting in the present invention.

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At Step S104, when the device A knows the information about other devices, it may initiate a peer-to-peer connection creating request to a certain device B. Upon receiving the request, at Step S105 the device B judges whether the request is accepted or not according to the relevant information of device A in the request. If

25   the request is not accepted, then a connection rejected response is sent back at Step S107; otherwise, at Step S106 a connection accepted response is sent back and a device connection is established therebetween. Subsequently, the devices A and B are interconnected, and the services and resources thereon can be exchanged and shared.

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c. when there is the resource management device, upon the device A is going to connect with another device, <u>at Step S111</u> the device A firstly sends a device searching request to the resource management device, and makes a search on the resource management device. Upon receiving the device searching request from the device A, <u>at Step S112 and S113</u> the resource management device makes a search among device registration information stored therein for an appropriate device. If a device B satisfying conditions is found out, <u>at Step S114</u> a device searching response is sent to the device A, and <u>at Step S115</u> the relevant information about the device B is sent to the device A in a format of device announcement message and in a unicasting manner. The device A sends a request to the device B directly, and upon permitted, these two devices are interconnected. In this case, the resource management device is a master device<u> MASTER</u>, and other devices including the device A and device B are slave devices<u> SLAVE1 AND SLAVEN</u>. Then, a device searching procedure performed among the master device(s) and the slave device(s) is shown in Fig. 5.<u> If no relevant device is found out, at Step S116, the resource management device notifies to device A that no relevant device is found out.</u>

Certainly, in the case where the resource management device exists, when each device applies to access the network, it will firstly register to the resource management device. In general, the resource management device makes device announcement to other devices in the network in a multicasting manner to describe that it is a resource management device and can provide an indexing service. When other devices receive the announcement message of the resource management device for the first time, they each register theirs own device information onto the resource management device in a unicasting manner, that is, each device sends a response message to the resource management device respectively. Once the registration is successful, the resource management device will form a master-slave relation with the device registered thereon, which means that the resource management device is the master device and all the devices registered on the resource management device are slave devices, and the relations between the master device <u>MASTER</u> and the slave devices <u>SLAVE1 AND SLAVEN</u> are shown in Fig. 4. In fact, whether the registration is successful during the

registration procedure is decided by the security authentication mechanism which mainly performed by judging a connection authentication key. If currently there is a plurality of resource management devices, which resource management device the device applying to access should register on is also determined by the security authentication mechanism.

In the performing course of the step c, a format of the device searching message and a format of the device searching response message are shown in Table 1 and Table 2 respectively. Table 1 is a detailed format of the device searching message, including name of field, content of field, type of field, and value range of the field. Table 2 is a detailed format of the device searching response message, also including field name, field content, field type, and value range of the field.

Table 1

FIELD NAME	CONTENT	TYPE	VALUE RANGE
message type	type of message	character string	fixed: DeviceSearch
serial number of message	serial number of message	unsigned integer	0 to 0xFFFFFFFF
destination device ID	device ID of message receiver	character string	32 bytes long character string
destination function ID	service ID of message receiver	character string	8 bytes long character string
source device ID	device ID of message sender	character string	32 bytes long character string
source service ID	service ID of message sender	character string	8 bytes long character string
search type	indicating the criteria of searching, which may be one of device name, device type, service name, service type or a combination thereof	unsigned integer	if 0th bit is 1, it refers to search in device name if 1st bit is 1, it refers to search in device type if 2nd bit is 1, it refers to search in service name if 3rd bit is 1, it refers to search in service type
device name	indicating the device name in searching	character string	character string with a maximum length of 256 bytes

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device type	indicating the device type in searching	unsigned integer	0 to 0xFFFFFFFF
service name	indicating the service name in searching	character string	character string with a maximum length of 256 bytes
service type	indicating the service type in searching	unsigned integer	0 to 0xFFFFFFFF

Table 2

FIELD NAME	CONTENT	TYPE	VALUE RANGE
message type	type of message	character string	fixed: DeviceAdvertisement
serial number of message	serial number of message	unsigned integer	0 to 0xFFFFFFFF
destination device ID	device ID of message receiver	character string	32 bytes long character string
destination function ID	service ID of message receiver	character string	8 bytes long character string
source device ID	device ID of message sender	character string	32 bytes long character string
source service ID	service ID of message sender	character string	8 bytes long character string
device name	the name of the found device	character string	character string with a maximum length of 256 bytes
device type	the type of the found device	unsigned integer	0 to 0xFFFFFFFF
device ID	ID of the found device	character string	32 bytes long character string
resource management identification	indicating whether this device is a resource management device or not	logic type	"True" or "False"
authentication type	authentication type expected by the device, according to which other devices can initiate a authentication procedure	integer	1 to 3
transmission security level	transmission security level expected by the device, other devices will communicate according to this transmission security level in the course of subsequent communication	integer	1 to 4
authorization type	authorization method of the device	integer	1 to 3
device state	the current state of device	character string	must be one of the following two character stings:

			1. "ALIVE", the device is in active state; 2. "BYEBYE", the device has left the network.
device information upgrading period	period for upgrading device state information, if other devices can not obtain new information about the device, then indicating that this device has left the network	integer	0 to 0xFFFFFFFF

According to Table 1 and Table 2, the first 6 fields of respective messages are the same, that is, the first field is message type; the second field is serial number of message, this serial number is used for retransmission of the message and the correspondence between the response message and request message; the four fields for the third to the six fields is used to indicate the sender of the message and the receiver of the message.

In practice, the device searching message and the device searching response message can be embodied in XML language. In summary, the above description is only about the preferred embodiments of the present invention, but is not intended to limit the scope of the present invention.

Abstract

~~The invention discloses~~ Disclosed is a method of searching for devices automatically in a network. The method ~~including the steps of:~~ comprises when two devices are interconnected, ~~firstly~~ searching, by an ~~device~~ initiating party, whether a ~~resource~~ management device exists in the network, if so, ~~then~~ sending a ~~device~~ searching request from the ~~device~~ initiating party to the ~~resource~~ management device, upon receiving the request, making a search, by the ~~resource~~ management device, among device registration information stored therein, after a device satisfying conditions is found out, information related to that device being immediately sent to the ~~device~~ initiating party, otherwise, informing the ~~device~~ initiating party that the information is not found; if not, announcing its own device information, by the ~~device~~ initiating party, to all other devices in the network, at the same time, monitoring announcement information of all the other devices, when receiving information of other devices, sending a connection request from the ~~device~~ initiating party to a device requiring connection, and completing corresponding operations ~~after receiving a response. The method makes automatic searching and connecting with respect to each other among devices possible so as to facilitate the user's operation and improve automatic and intelligent performance of the network~~.